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A Cloud Computing Solution for EHR Maintenance in PHCC

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***Abstract*—The data maintenance of patient's health requires a great deal of labor work to collect and analyze the information. Existing processes like client-server model stores data in house, requires a server, hardware and software be installed in the primary health care center which is usually slow and error prone, introducing a latency that prevents real-time data accessibility. This scenario restrains the clinical diagnostics and monitoring capabilities. We implemented a cloud-based approach for the maintenance of electronic health records (EHR) in primary health care center (PHCC) at Krishna district, Andhra Pradesh, India. The results shows season wise, area wise diseases and their medicinal requirement. Hence it can be used by any PHCC to maintain health records of any patient.**

***Keywords*—Patient Health Profile, EHR, PHCC, Client-Server model, Cloud computing.**

I. INTRODUCTION

The cloud based Primary Health Care system consists of the healthcare providers, pharmaceutical companies, IT solutions and the patients. The healthcare process involves massive healthcare data which exists in different forms on disparate data sources, in different formats where patient information is entered into electronic health record (EHR) systems.

Physicians diagnose the patient and the clinical observations are stored in EHR systems. In this process, the doctors retrieve the health information of patients and analyze it to diagnose the illness. Doctors can take expert advice by sharing the information with consulting specialists.
Patients can manage their prescriptions and associated information such as dosage, amount, and next visit and have access to their health history and information stored in the cloud.

II. RELATED WORK

Most clinical encounters are still recorded by hand in a paper record. This is not without reason. Dick and Steen (1991) note that the traditional paper record is still used due to its familiarity to users, portability, ease of recording "soft" or "subjective" findings, and its brows ability for non-complex patients. There is also a sense of ownership of paper records, due to their being only one copy, which increases the sense of their security (although it will be noted below that this may be a false sense of security).

Cloud-based data is safer than paper and client-server records in the event of a natural disaster or fire because the data is backed up securely in multiple locations. Backups for client-server records are most vulnerable to breach in transport to storage facilities, unlike cloud systems.

EHR systems basically fall into two categories: cloud-based or client-server. In a cloud-based system, a practice's data is stored on external servers and can be accessed via the web, requiring only a computer with an Internet connection.

Client-server systems store data in house, requiring a server, hardware and software be installed in the physician's office. While in-house servers have traditionally been the norm, practices are increasingly switching to the cloud for a number of reasons.

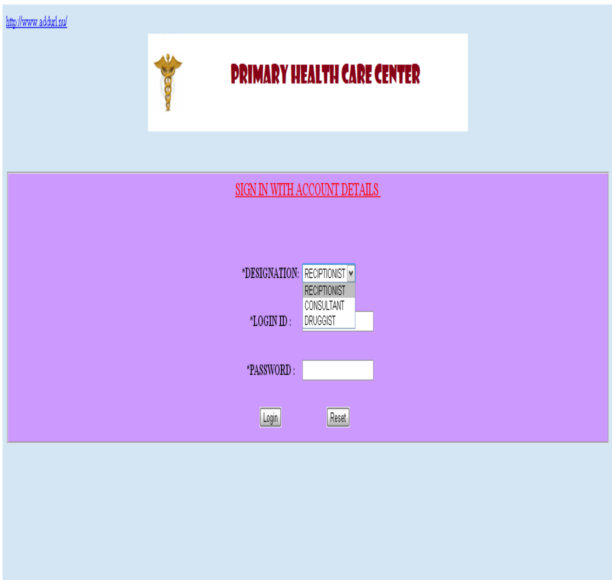

Fig 1. Above diagram specifies the client application through which receptionist, consultant and druggist can log in

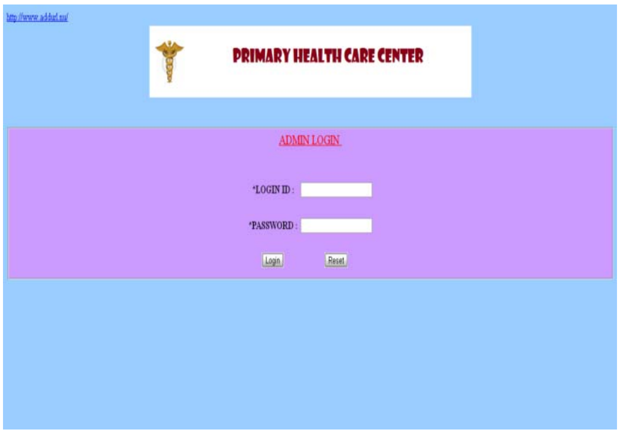

Fig 2. Admin login page.

III. Motivation

The main motivation behind this application design is patients may misplace or lost the records and also it access for records by other clients like doctors , pharmaceutical companies consulting specialists is not possible always. The process of maintaining files for maintaining treatment records in hospital. To avoid these problems it is necessary to design an application in which there will be no matter of maintaining records physically. Instead of creating records in bulk we provide a space to enter all the details and they are stored in remote server and they can be retrieved from anywhere and in anytime. In this application regardless of maintenance of PHCC.

IV. Public Cloud Platform

Public cloud is the concept of group of computers in network and their resources based on standard cloud computing model, in which a service provider provides their services as per the requirement of the user. It may be platform, software (application), and infrastructure. Likewise according to our requirement whether it may be free or pay as per we use. Public cloud storage may be a storage of applications, storage of our personal data that should be available at anywhere at any time. There are many service providers for public cloud establishment like Amazon, Microsoft and Google which are having their own cloud servers and they can provide their services to us with a low cost or they will also provide free trail services.

In our application we deployed our application in public cloud platform and through URL anyone can access our application. Anyone means the sense the users of this application. Though it can be accessed globally other users may not know about this application. If anyone tried to make use of this application it will not be accessed because the public cloud providers apply security systems for our application, so no one can use our application illegally.

V. Cloud Database

To store the data regarding every patient we need to store the information in huge database. The cloud service provider itself will provide database service to our application. To use any database service or to get those services from the service provider we need to activate our account for billing. The service provider will give a login ID and password for your database account. In that account we can create fields in database and the service provider will create a host name for our application and we need to include that host name, username and password in our account. Whenever our application launched it will automatically connects to database and the values will be retrieved from the database.

In this application there is no need for manually entering the date. The date will automatically generate in the field according to the system time and date.

VI. Working of Clients

In this application they are supposed to do their respective work without any co-incidence with other clients.

A. Receptionist

Receptionist plays a vital role in working of PHCC and also patient data maintenance. Receptionist needs to verify every patient who was coming to hospital. There may be old patients who are not familiar with this application and whose data is not in this application. Then receptionist will register that patient with new ID and enter the previous disease information as per the last review when it is manual data maintenance. From that moment that patient treatment data will be maintained in remote server without maintaining records.

Receptionist even can see the last visit of the patient and if the patient forgot his/her ID number receptionist must ask patient the phone number that was given at the time of registration. By that phone number patient ID can be retrieved from the server. When the patient comes for next review, receptionist can enter his/her ID and can view the last review and also whether that patient is following mentioned review date or not. Receptionist can change his/her password, but he needs to inform to admin.

B. Consultant

Consultant is the other user of this application and who can view the patient past treatment data and also can give new review by clicking on the hyperlink "Add Review". When they clicks on that link another page that is review page opens with patient ID as entered previously by the consultant and the current system date. There will be the diseases list and also a field to enter treatment that has done to that patient. Consultant needs to select the drug and can prescribe for that patient.

C. Druggist

Druggist is the last user for this application. Druggist can perform some important operations within his limits. In PHCC medical facility is free of cost and so if there is new stock for any medicines druggist needs to enter those in inventory list. That is the list which shows the list of medicines that are provided by government of India. When the patient comes to pharmacy druggist needs to enter patients ID, the list of medicines which were prescribed for the patient for the latest issue. Total list will be appearing and after clicking issue the medicines count will be deducted from database. As per the list the druggist will issue the medicines for the patient.

Druggist has the capability of adding new medicine into the database. Whenever new stock came he can add that stock details into database. Druggist has the right to change his own password. But that work should be mentioned to admin by a call.

VII. Working of Admin

Admin is the one who monitors all the work in PHCC and can take 3 kinds of reports from database. Daily reports, monthly report and category wise report

A. Daily Reports

In daily reports we need to select the date or by default the current system date will be displayed. After selecting the date he needs to click on submit button. A list will be displayed which gives the complete treatment details that day. At bottom of the page the total number of cases listed on that day.

B. Monthly Reports

In monthly report we need to select month. But we need to select any month which must be current month or the previous months. The next month option will be disabled and we cannot select that month.

After selecting month for example March, then a list will be generated according to the list in the database. At bottom of the page there will be the total number of cases registered of reviewed in that month and we can find that which disease is mostly reviewed. A sample monthly report for a month of March as shown in Fig. 3.

Fig 3. Monthly report in the month of February 2014.

In the above diagram we have a small hyperlink which navigates to the graph. The graph according to the count of the cases is shown in Fig.4.

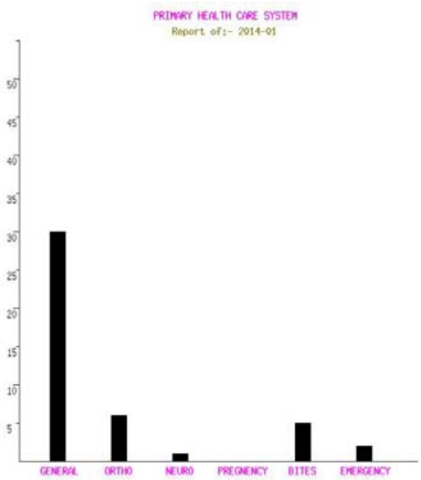

Fig 4. Graph representation of the monthly report in the month of February.

C. Category wise Report

In this type of report we can see a specific disease rating in a specific year. That is, we need to select a disease and we needs to select the year in which we are willing to view the number of cases recorded in that year. After selecting that requirements click on submit. The total list will be displayed as the user requirement. The list consists of the specific disease records in that specific year in every month.

For example we selected the category general in the year 2014. The list is shown in Fig.5.

Fig 5. Displaying the list of cases recorded on that category in a specific year.

At the Bottom we have a small link which shows the graph of that category in every month of that specific year. A sample graph for the general category as shown in Fig.6.

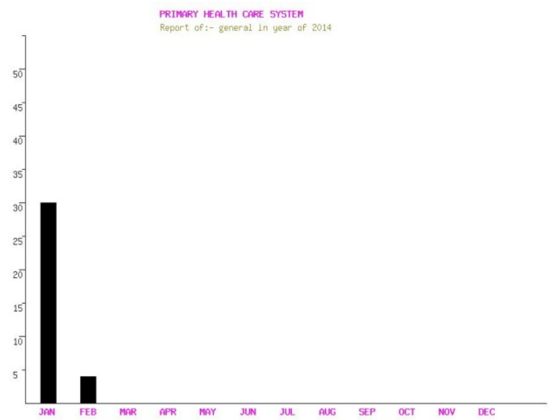

Fig 6. Graph for the general category in 2014.

Like this the reports will be generated by admin by the data available in the database.

VIII. CONCLUSION

Primary health care management system deals with the concept of storing the patients' treatment data and completely avoids the storage of patients' treatment data as the records. This application stops the traditional procedure of patient treatment data maintenance that is as a file. This application can be available at any time and can be accessed from anywhere if the user is an authorized one. If anyone tried to misuse this application it can't be possible. Because, every user of this application is assigned with a user ID, by which all the user's needs to login into the application. Hence The cloud can provide several benefits to all the stakeholders in the healthcare system through systems such as health information management system, laboratory information system, pharmacy information system, etc. With public cloud based EHR systems hospitals do not need to spend a significant portion of their budgets on IT infrastructure

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